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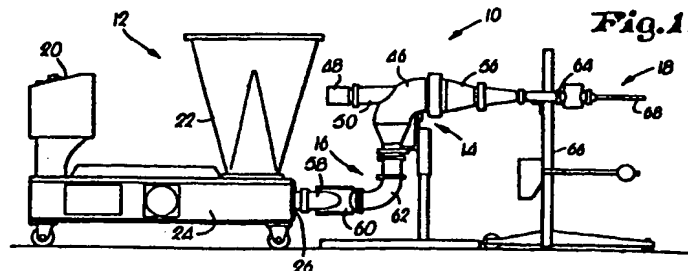
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㉓ Continuous vacuum grinding method and apparatus.

㉔ An improved method and apparatus for the continuous vacuum grinding of meat or other products is provided which permits continuous deaeration and grinding so as to materially enhance the organoleptic properties of final meat products such as sausages and the like. Broadly speaking, the apparatus of the invention includes a pumping apparatus (12) together with a grinder (14) and a closed conduit (16) coupling the pump and grinder; deaeration apparatus is also provided which serves to deaerate the meat products prior to grinding,

and the latter are maintained in that condition throughout the grinding operation. In preferred forms, use is made of a reciprocating piston-type pump together with remote, separately powered grinding apparatus. In this form of the invention, deaeration is accomplished by means of apertured pistons (34) within the pumping unit which are operatively coupled to a vacuum pump (38) or other suitable evacuating device.



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CONTINUOUS VACUUM GRINDING METHOD AND APPARATUS

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Background of the Invention1. Field of the Invention

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This invention relates to a method and apparatus for deaerating food in a continuous grinding operation to provide an anaerobic environment in the grinder and thus improve the organoleptic properties of the final ground food products.

2. Description of the Prior Art

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In the manufacture of food items such as sausages or other meat products, the ultimate appearance or eye appeal of the products is of paramount importance. In sausages for example made up of ground or comminuted meats, processors go to great lengths to minimize the phenomenon of "smearing", or the loss of particulate identity in the products. By the same token, it is highly desirable to maintain a strong red meat color in many sausage products.

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Previously, large batch-type vacuum choppers have been used in the meat industry. In practice, a charge of meat is placed within the tub of such a chopper, and the lid closed; a vacuum is then drawn to remove air, whereupon chopping knives within the tub are activated to comminute the meat. While these types of choppers are known, they are deficient in that they preclude continuous operations; moreover, the meat is necessarily subjected to the effects of air after the chopping step is completed as a result of unloading and subsequent handling.

(Docket No. 18881)

1 In addition, many food products are graded
or gradable according to bacteria count inasmuch as
product quality and shelf life depend largely on the
5 extent to which the bacteria is either killed or its
growth prevented or reduced during processing and
subsequent to marketing, prior to preparation for
consumption. Many harmful microorganisms, especial-
ly bacteria, grow most rapidly in the presence of
10 oxygen. Hence, whenever processing includes grind-
ing of meats prior to packaging, the bacterial
problem can be reduced quite substantially if air is
removed before the product is introduced into the
grinder.

15 U. S. Patent No. 4,479,614 describes a
highly advantageous grinding apparatus especially
designed for use with a dual reciprocable piston
pump of the type sold by the Marlen Research Cor-
poration of Overland Park, Kansas. The grinder
20 device is operated via a separate motor and drive,
and is operatively coupled to the pump through a
valved conduit assembly. The dual piston Marlen
pumps referred to above are designed to deliver a
high pressure stream of food or other products, and
it has been known in the past to equip such pumps
25 with apertured pistons and air-conveying conduits so
as to deaerate successive product charges prior to
pumping. The '614 patent does not, however, suggest
or intimate use of a deaerating piston pump in
conjunction with a grinding device in order to
30 achieve true continuous vacuum grinding.

 Accordingly, there is a real and unsatis-
fied need in the art for a method and apparatus
which permits continuous grinding of meat or other
products under anaerobic conditions to improve the
35 appearance and shelf-life qualities of final ground
products.

1 Summary of the Invention

5 According to the principles of the instant invention, therefore, in a process of continuously feeding particulate food products entrained with air from a dispenser to a grinder, there is introduced a step in the process which removes the air prior to introduction into the grinder and maintains such anaerobic conditions so that continuous grinding is carried out under optimum conditions.

10 Especially advantageous in the procedure is the fact that deaeration takes place continuously and automatically, without operator attention. Moreover, such improvements in the apparatus and method of the invention are of such nature as to
15 create at least a partial vacuum, by use of an air pump or other artificial means, to exhaust to a high or the highest degree all the entrained air in the product while it is in the line between the dispenser and the grinder. Additionally, the air
20 removal step is accomplished without any significant slow-down in the process which involves charging of the grinder with the product to be ground.

25 To these ends, the product is introduced into the grinder continuously in individual charges, so that the grinder can operate continuously. While each charge is so individualized, air is withdrawn therefrom. Then the deaerated charge is forced into the grinder in such manner as to prevent reaeration during each such force feeding step prior to actual
30 reception of the batch in the grinder.

35 Advantageously, use is made of the above-described dual piston pumping assembly commercialized by the Marlen Research Corporation of Overland Park, Kansas; such device is of the type equipped with apparatus for deaerating successive charges of

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1 product as they are formed and expelled to the
grinder. A closed conveying system between the pump
and grinder assures that the desired anaerobic
5 conditions are continuously maintained until the
grinding step is completed.

In the Drawings

10 Figure 1 is a side elevational view of
apparatus made pursuant to the present invention and
having the capability of continuous vacuum grinding;

Fig. 2 is a fragmentary cross-sectional
view of that portion of the apparatus which operates
to charge and deaerate product, as well as feed the
product charges to a grinder and thereupon grind the
15 same;

Figs. 3-5 are fragmentary, schematic,
detailed cross-sectional views illustrating the
successive steps of charging, deaerating and force
feeding a grinder with the particulated materials;
20 and

Fig. 6 is a view of a pair of containers
of ground meat products after being formed into
separate extrudates, illustrating the differences
between deaerated grinding in accordance with the
25 present invention, and conventional grinding.

Description of the Preferred Embodiment

Turning now to the drawings, a continuous
vacuum grinding apparatus 10 is illustrated in Fig.
30 1 and broadly includes a dual cylinder, reciprocal
piston pump 12, a separately powered, continuous
grinder 14, conduit structure broadly referred to by
the numeral 16 operably interposed between the pump
12 and grinder 14, and a commercially available,
35 dual horn stuffing apparatus 18 coupled to the
outlet of grinder 14.

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In more detail, the pump 12 is a commercially available unit made and sold by the Marlen Research Corporation of Overland Park, Kansas and includes a control console 20, infeed auger-hopper 22, a piston assembly housing 24 and a pair of outlets 26.

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Referring to the schematic illustration of Fig. 2, it will be seen that a pair of piston and cylinder assemblies 28, 30 are housed within housing 24 and are operably communicated with the respective outlets 26. Each assembly 28, 30 is identical and includes a reciprocable, tubular sleeve 32, a reciprocable apertured piston 34 within the sleeve 32, and a tubular, rearwardly extending piston rod 36 secured to the piston 34. The assemblies 32, 34 reciprocate within a chamber of housing 24 communicating with hopper 22. In addition, a vacuum line 38 is coupled to the rearmost end of rod 36 and communicates with the tubular passageway defined by the latter.

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Each piston 34 includes a plurality of evacuating apertures 37 therethrough. In addition, the forward end of rod 36 includes a radially extending plate 40 having pins 42 located for insertion within corresponding apertures 37 during operation of the assembly as will be described. Further, somewhat longer anti-rotation guide pins 44 are provided on piston 34 which reciprocate within appropriate piston apertures so as to prevent axial rotation of the piston during operation of pump 12. Reciprocal operation of the sleeves 32 and pistons 34 is accomplished by means of conventional hydraulic circuitry and need not be described in detail herein. Moreover, the overall pumping unit 12 is described in U.S. Patent No. 4,097,962 and is more

1 generally described in the aforementioned Patent No.
4,479,614; both of these prior patents are incor-
porated by reference herein.

5 The grinder 14 includes an angled inlet
housing 46 which supports a hydraulic motor 48 and
knife drive 50. A multiple blade grinder knife 52
is affixed to the forward end of drive 50, and
coacts with an apertured grinder plate 54. The
10 overall grinder 14 further includes a frustoconical
outlet housing 56 which leads to and communicates
with the inlet of stuffer 18.

The conduit structure 16 includes a bifur-
cated, generally U-shaped conduit 58, the legs of
which are respectively coupled to the outlets 26
15 (see Fig. 2). A shiftable diverter valve 60 is
located at substantially the apex of conduit 58 for
the purpose of alternately opening the legs of the
latter. A transfer conduit 62 of smoothly arcuate
design is coupled between the outlet of valve 60 and
20 the inlet of housing 46 as can be readily appreci-
ated from a study of Fig. 2.

The stuffer 18 is of conventional con-
struction and includes a stuffing head 64 supported
on an upright standard 66. The head 64 is in turn
25 coupled to a pair of laterally spaced apart horns 68
which are adapted to receive casings during sausage
filling operations.

In use, meat or other product to be con-
tinually vacuum ground is introduced into hopper 22
30 whereupon it is augered into the described piston
assembly chamber within housing 24. This condition
is illustrated in Fig. 3, where it will be seen that
one of the sleeves 32 is in its retracted position
(the other sleeve not shown would be in its extended
35 position and the piston associated therewith in its

1 forward product delivery stroke). During retraction
of the sleeve 32 to the Fig. 3 position, a vacuum is
drawn through line 38 (there being a vacuum pump or
5 other suitable structure, not shown, operably coupled with the line 38). Such is accomplished by
virtue of the apertures 37 and tubular rod 36,
permitting deaeration of the products.

Next, the sleeve 32 is shifted forwardly
to its closed position shown in Fig. 4 so as to
10 capture and entrap a charge of meat or other product. During this forward sleeve shifting, the
vacuum conditions are maintained so as to assure
full deaeration.

In the next step illustrated in Fig. 5,
15 the vacuum is relieved and the piston rod 36 and
piston 34 are moved forwardly so as to expel the
charge of deaerated product out of pump 12 and into
the associated leg of conduit 58. At this point the
pins 42, 44 are moved forwardly into their associated
20 piston apertures to clear the latter and block
flow of meat into the vacuum line, and the piston
forcibly expels the deaerated charge from the associated sleeve. During this sequence, the valve 60
is also shifted so as to open the associated leg of
25 the conduit 58 to conduit 62, so as to define an
open flow path for the deaerated product to grinder
14. During the foregoing operation (described with
reference to Fig. 5), it will of course be understood
that the adjacent piston assembly is operating
30 in an alternative fashion, i.e., the sleeve 32
thereof is retracted and thence pushed forwardly to
entrap a charge of product. In this fashion, the
pump 12 operates in a batch-continuous manner, so as
to continuously feed a stream of product to the
35 grinder 14. In the latter connection, it will be

1 observed that because of the completely closed
nature of the overall system from pumping through
the grinder 14, the product remains fully deaerated
5 until it emerges from the stuffer 18 and is pack-
aged.

Actual tests using apparatus as herein
described have demonstrated that the continuous
vacuum grinding affords substantial advantages in
10 terms of organoleptic properties of the final prod-
ucts. To give but one example, attention is direct-
ed to Fig. 6, which is a comparative photograph of
sausages produced in accordance with the present
invention (upper half of photograph) versus a prod-
15 uct made using conventional equipment but with the
same starting materials. Specifically, both sausage
products were made with meat consisting of 46.6
percent fat and 53.4 percent lean, reduced through a
5/32 diameter hole grinder plate. The product made
20 in accordance with the present invention as shown in
the upper half of the photograph employed a Marlen
dual piston pump, together with the depicted grinder
and dual horn stuffing unit illustrated in the
drawing. On the other hand, the prior art product
25 shown in the lower half of the photograph was pro-
duced using a commercially available Weiler grinder
and a Handtman stuffing device.

As can be readily observed from the photo-
graph, the product made by the present invention
30 exhibited substantially more particulate identity,
with a minimum of "smearing." When it is considered
that both of the products included the same fat to
lean ratio, it will be appreciated that the continu-
ous vacuum grinding process of the invention materi-
35 ally enhances the desirable organoleptic properties
of the final product.

1 In addition, the invention gives a better
red meat color than previous methods, and moreover
enhances the shelf life of the resultant products.
5 The continuous grinding operation also allows easier
density control and more sanitary operations because
of the maintenance of deaerated conditions between
pumping and grinding.

10 A wide variety of particle sizes can be
used in the production of meat products using the
method and apparatus of the invention. Generally
speaking, the meat particles should range in size
from about 1/8 inch up to about 3 inches, with lean
particles being somewhat larger than fat particles.
15 Generally, the meat should be refrigerated and below
about 34° F.

20 While a primary utility for the invention
is in the production of sausage products, those
skilled in the art will recognize that it finds
utility in chubb filling and other meat applications
as well.

25 Finally, product densities can be in-
creased by using the present invention inasmuch as
air is removed prior to the grinding operation.
That is to say, in conventional stuffing operations
the meat is ground in air and free air thus becomes
emulsified and trapped within the meat itself. This
entrapped air is very difficult to remove and thus
lowers the product density. However, the present
invention removes air prior to the grinding step so
30 that such free air has no opportunity to become
entrained in the meat during grinding.

1 Claims

5 1. In apparatus for grinding of products including a pumping assembly for delivering a stream of product to be ground, grinding means for receiving said product stream and grinding the same, and conduit means operatively coupling the pumping means and grinding means, the improvement which comprises:

10 means for removing air from said product in said apparatus and prior to said grinding means; and

15 means for continuously maintaining said product in said deaerated condition within said apparatus and until ground product is expelled from said grinding means.

20 2. The apparatus of Claim 1, wherein said pumping means comprises a reciprocable piston pump, said air-removing means comprising structure defining an aperture through said piston, and means for withdrawing said air through said aperture.

25 3. The apparatus of Claim 1, said pumping assembly comprising a pair of reciprocable pistons, and a reciprocable sleeve receiving each piston.

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4. In a method of grinding a stream of product including the steps of directing product to pumping means, operating said pumping means to generate a stream of said product therefrom, and grinding said product in a grinder operatively coupled with the pumping means, the improvement which comprises the steps of:

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removing air from said product prior to entrance thereof into said grinding means; and

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continuously maintaining said product in said deaerated condition until ground product is expelled from said grinder.

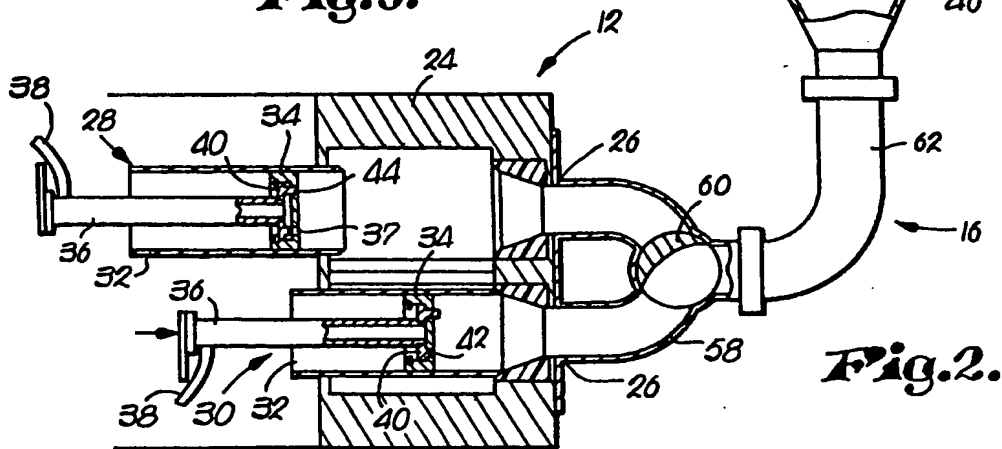
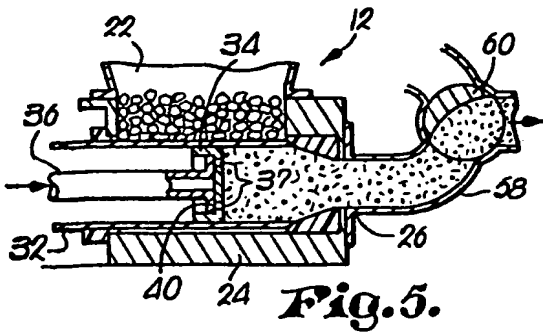
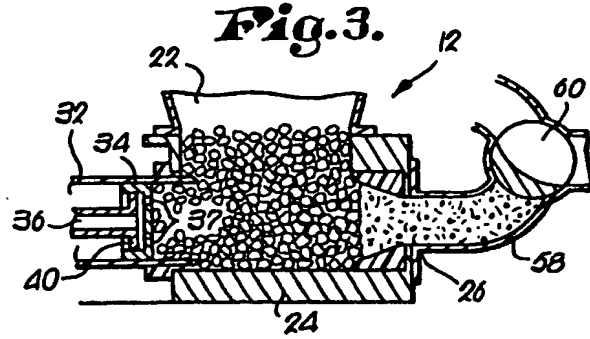
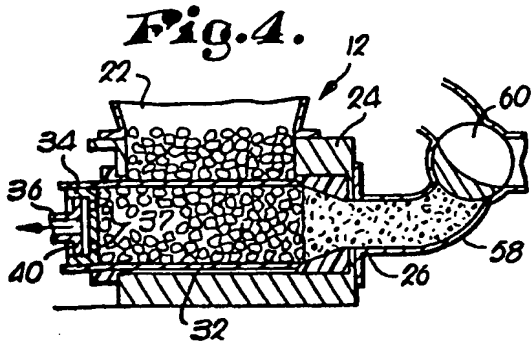
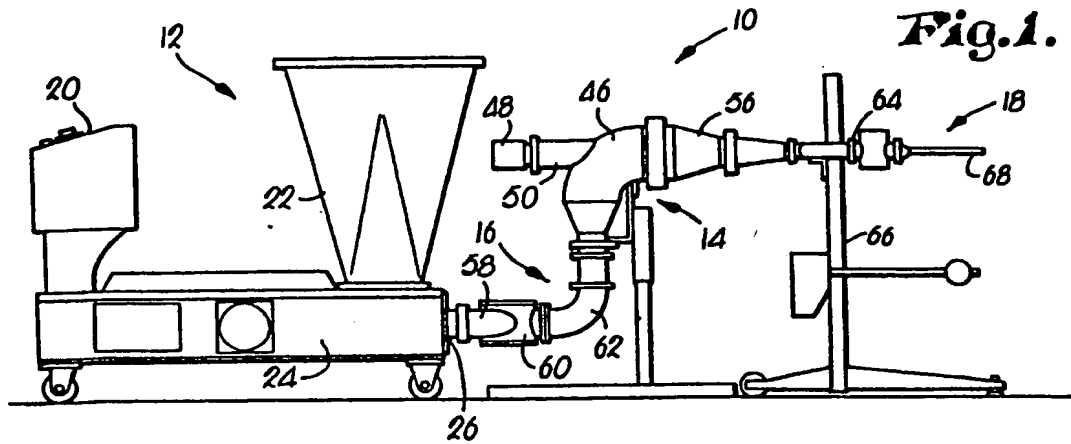
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5. The method of Claim 4, said air removing step comprising the step of withdrawing air from said product within said pumping means.



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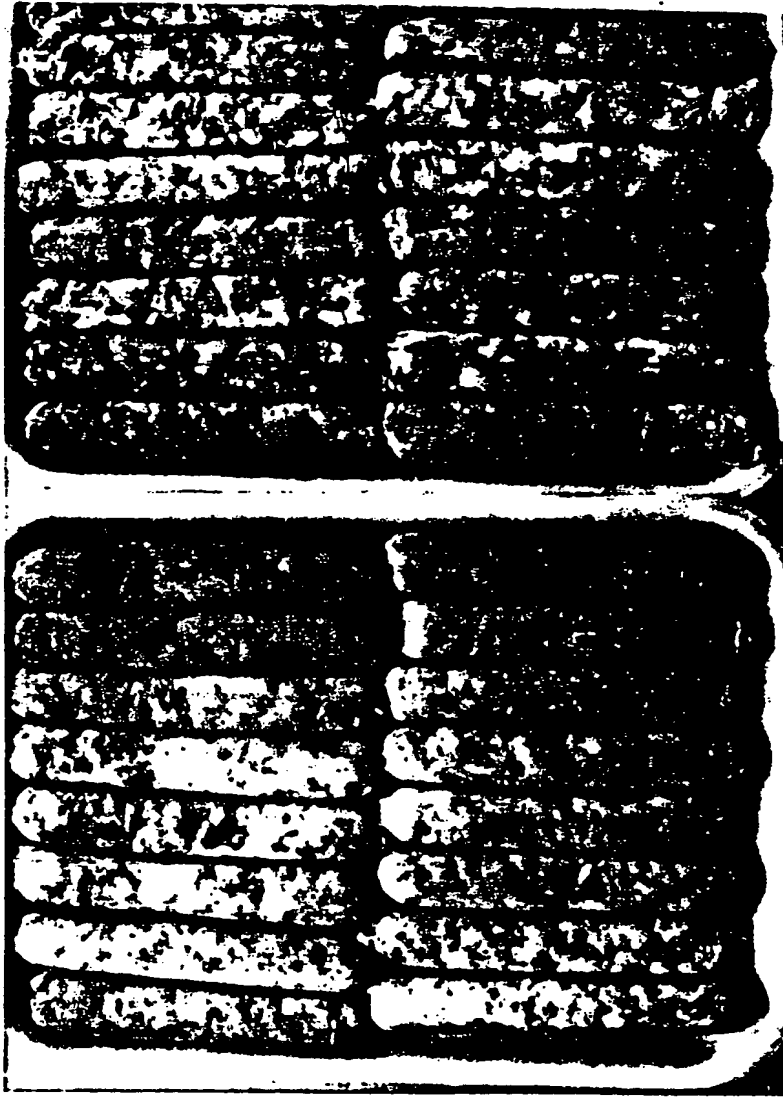


Fig.6.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-B-1 266 661 (OSCAR-MAYER KARTRIDG PAK) * Whole document *	1,4,5	A 22 C 7/00 A 22 C 11/00
A	GB-A- 862 285 (SCHNELL) * Whole document *	1,4,5	
A	US-A-3 537 129 (ORLOFF) * Whole document *	1,4,5	
A	FR-A-1 189 128 (GORGET) * Whole document *	1,4,5	
A	US-A-3 042 964 (ROSENTHALER) * Column 3, lines 44-61; figure 1 *	1,4,5	
A	FR-A-1 325 528 (BIANCHI) * Whole document *	1,4,5	TECHNICAL FIELDS SEARCHED (Int. Cl.4) A 22 C
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D,A	US-A-4 097 962 (ALLEY) * Whole document *	2,3	
A	GB-A-1 143 657 (KALLE) * Page 1, lines 59-60 *	2	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23-01-1987	Examiner DE LAMEILLIEURE D.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons A : member of the same patent family, corresponding document	

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EP 86 10 8145

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DOCUMENTS CONSIDERED TO BE RELEVANT			Page 2
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
A	US-A-3 742 556 (BEASLEY)		
A	US-A-3 371 690 (HAWLEY)		
A	GB-A-2 156 444 (SELLEY)		
A	DE-A-3 311 799 (KOPPENS)		
A	GB-A- 978 140 (OSCAR-MAYER-KARTRIDGE)		
A	FR-A-2 274 223 (MOVLIN)		TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
A	FR-A-2 287 385 (CHEMETRON)		
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Place of search THE HAGUE		Date of completion of the search 23-01-1987	Examiner DE LAMEILLIEURE D.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			